

**CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE
FERTILIZER RESEARCH AND EDUCATION PROGRAM**

Interim Report: January 1 – June 30, 2017

Evaluation and demonstration of nitrogen and phosphorus management in organic leafy green vegetables production on the Central Coast

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Project leaders

Richard Smith, UCCE Vegetable Crops Farm Advisor, Monterey, San Benito and Santa Cruz Counties, 1432 Abbott Street, Salinas, CA 93901, 831 759-7357, rifsmith@ucdavis.edu

Mike Cahn, UCCE Irrigation Farm Advisor, Monterey, San Benito and Santa Cruz Counties, 1432 Abbott Street, Salinas, CA 93901, 831 759-7377, mdcahn@ucdavis.edu

T.K. Hartz, Extension Specialist, Department of Plant Sciences, University of California, 1 Shields Ave. Davis, CA 95616, 530 752-1738, tkhartz@ucdavis.edu

OBJECTIVES

1. Demonstrate and evaluate the proportion of crop N needs that are provided by soil organic matter mineralization in organic leafy vegetable production under coastal climate conditions
2. Demonstrate and evaluate mineralization behavior of a group of commonly used dry and liquid organic fertilizers under field conditions on the Central Coast
3. Demonstrate and evaluate the N and P balance of organic production fields (N and P inputs, mineralization and removal)
4. Refine and update algorithms of nitrate mineralization from soil organic matter in CropManage
5. Conduct outreach to growers via demonstration plots and UC nutrient management meetings, newsletters articles, blogs and scientific reports.

SUMMARY

This project is in the middle of the second field season conducting a survey of nitrogen mineralization and phosphorus nutrition of organic farms on the Central Coast. We are working with cooperating growers on commercial organic vegetable farms to survey soil and fertilizer mineralization during the growing cycle of baby vegetables and full-term lettuce. In the first year of this project we observed that soil mineralization made modest contributions to the N needs of the crop. Organic fertilizers had a two phase mineralization: fast initial N release (within 2-3 weeks) followed by a more slow and gradual release of N over the remainder of the growing cycle. We are conducting a second year of evaluations to confirm these observations. Growers are interested in this

project because they have many question about organic fertilizer and are hoping that this project will be able to answer some of these questions.

WORK DESCRIPTION

Workplan Year 2

Task 1: Conduct evaluations of N mineralization in organic fields:

Sub-task 2.1 Conduct N mineralization evaluations in field trials:

1. Initiate nitrogen mineralization trials with cooperating growers in commercial organic baby and romaine lettuce production fields. Field sites will be selected to include a diversity of locations, growers and soil types. Five mineralization evaluations will be conducted of baby and five of full-term romaine lettuce. A comparison of unfertilized plots with the grower standard fertilizer program will be established in each field. Soil assays during the cropping cycle will include: total N content of the soil, organic matter content and mineral N (to 12 inches), nitrate in the water and water extractable N and C. Crop biomass N and soil mineral N will be evaluated 3 times during the crop cycle of baby lettuce (average crop cycle = 30 days) and 4-5 times for full-term romaine (average crop cycle = 65 days).

Six trials have been initiated with cooperating growers in commercial organic vegetable farms thus far in 2017. Replicated fertilized and unfertilized plots were established to measure soil N mineralization and phosphorus (P) from organic fertilizers.

Sub-task 1.2 Evaluations of N and P release from dry and liquid organic fertilizers

1. Field evaluations of N and P release from organic dry fertilizers will be conducted to determine the efficiency of release given the short crop cycle of both baby and full-term romaine lettuces. Evaluations of the type of material as well as method of application will be conducted. Mesh bag evaluations collecting enclosed residual fertilizer and determining the level of mineralization over time will be conducted. Laboratory incubations will be conducted of both dry and liquid fertilizers. The rate of net N mineralization from the organic fertilizers will be estimated as the increase in mineral N over time, minus that measured in control (unfertilized) soil.

An additional round of evaluations of mineralization of dry organic fertilizer placed in mesh bags will is being conducted in 2017 to provide a second year of these evaluations. Bags containing 20 grams of organic fertilizer were made out of floating row cover material. The bags have been placed in the untreated control in a commercial vegetable production field. Four replicates are pulled from the field each week. The contents of the bag are dried, weighed and analyze for total nitrogen.

Sub-task 2.3 Balance of N and P inputs in the soil and lettuce crops

1. Evaluations of N and P inputs from fertilizer, mineral N in irrigation water, composts and crop residues will be conducted. Nitrogen and P in fertilizer will be accounted for based on the application rates and analysis. Quantities of N in

the irrigation water will be estimated based on the concentration of N in the irrigation water and the application rates as measured by a flow meter or estimated based on the number of hours of irrigation applied to the field. The N content of composts will be estimated based on application rate and N and P concentration. Nitrogen and P content of crop residue will be measured by harvest evaluations in which the quantity of residue and its N and P content will be measured. Outputs include the biomass removed in the harvested product will be estimated by measuring the quantity of harvested biomass and its N and P content. These assays will provide information on the efficacy of N and P application vs uptake and removal. Soil will be sampled during the off-season to examine mineralization of N during the winter. Evaluations will be conducted on five of the 10 fields discussed in objective 1. Soil samples will be collected from 1-12 and 12-24 inches deep once per month during the off-season and after key rainstorms capable of leaching significant quantities of nitrate from the soil.

A full round of these evaluations were conducted in 2016 and were reported in the 2016 Annual Report. A second round of these evaluations is underway and will be summarized at the end of the field evaluation season.

Sub-task 2.4 Refine N mineralization algorithms currently used in CropManage

1. Algorithms used by CropManage will be updated and refined based on the data developed by this project. Nitrogen mineralization algorithms will be added to CropManage to ultimately make the N management aspect of CropManage useable by organic vegetable producers.

These task will be addressed at the completion of the 2017 field evaluation season when we have two years of evaluations in-hand.

Sub-task 2.5 Reports and extension

1. Provide annual report to FREP
2. Report summary of two years of results to the annual Salinas Valley Irrigation and Nutrient Management Meeting, UCCE newsletters, blogs and trade publications.

A presentation entitled, “Evaluations of Organic Fertilizers” was made by Richard Smith at the 2017 Salinas Valley Irrigation and Nutrient Management Meeting on February 23 in Salinas. An article entitled, “Release of mineral nitrogen from organic soils and fertilizers investigated” was published on the UCCE Monterey County Blog on April 21, 2017: <http://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=23882> .

Workplan Year 3

Task 3: Conduct outreach and a demonstration field demonstration

Sub-task 3.1 Conduct a field demonstration at the USDA Spence Research Station

1. Conduct a field day and invite growers and consultants to view the field demonstration and discuss N mineralization dynamics of in organically managed soils and from common fertilizer materials and potential for carryover of N and P from prior crops and fertilizer applications that can be taken into account in fertilizer application planning.

These task will be completed during the 2018 season

Sub-task 3.2 Reports and extension

1. Final report to FREP
2. Provide report of final results to the annual Salinas Valley Irrigation and Nutrient Management Meeting and annual FREP Conference
3. Publish results in UCCE newsletters, trade journals and prepare peer reviewed manuscript for submission to a scientific journal

These task will be completed during the 2018 season